What is claimed is

1. A liquid crystal display (LCD) device, comprising:

a gray signal modulator for receiving gray signals of the input image data, and for outputting modified gray signals by considering the current and the preceding field image data, or by considering the character of input image data;

a data driver for converting the modified gray signals into the corresponding data voltages for driving the liquid crystal molecules in each to produce image signal;

a gate driver for continuously supplying the scanning signals, and

a liquid crystal display panel, comprising a plurality of gate lines for transmitting said scanning signals, a plurality of data lines being insulated from and crossing the gate lines for transmitting image signals, and an array of pixels forming by the areas surrounded by the said gate lines and said data lines.

2. The gray signal modulator as described in claim 1, wherein the signal preprocessor is specifically designed as a noise-reduction preprocessor for reducing the noise induced from the input gray signals.

3. The LCD device as described in claim 1, wherein the gray signal modulator comprises:

an input terminal for receiving the gray signals of input image data;

a frame memory for storing the preceding field image data of the input gray signals;

a controller for controlling the frame memory and the reading and writing processes thereof;

a signal preprocessor for preprocessing the gray signal from the input terminal or detecting the character thereof;

a gray signal data converter for outputting the modified gray signals by considering the gray signals of the preceding field image data transmitted from the frame memory and the outputs from the signal preprocessor, and

an output terminal for transmitting the modified gray signal to the data driver.

4. The gray signal modulator as described in claim 3, wherein the signal preprocessor is specifically designed for detecting a certain character of input gray signal for providing the gray signal data converter to select a suitable converting scheme.

5. The signal preprocessor as described in claim 4, wherein the detection of said character of input gray signal data includes the detection of different video systems, different frame rates, different images with different signal-to-noise ratios, different interfaces or user dependent parameters.

6. A method for driving a LCD device, comprising

inputting gray signals of input image data into a gray signal modulator;

modifying the input gray signals into modified gray signals by the gray signal modulator;

outputting the modified gray signals to a data driver;

converting the modified gray signals into corresponding image data voltages by the data driver, and

driving each pixel of the LCD device by the image data voltages, thereby achieving the desired brightness in each pixel of the LCD device.

7. The method for driving a LCD device as described in claim 6, wherein the method for modifying the input gray signals by the gray signal modulator is achieved by considering the current and the preceding field image data, and by considering the character of input gray signals, thereby outputting the suitable modified gray signals.

8. The method for driving a LCD device as described in claim 7, wherein the method for modifying the input gray signals by the gray signal modulator further comprises a signal preprocessor, which is specifically designed as a noise-reduction preprocessor for reducing the noise of input gray signals.

9. The method for driving a LCD device as described in claim 8, wherein the noise reduction is achieved by considering the difference between the current

and the preceding field image data, wherefrom the input gray signal is considered as signal and is outputted directly if the difference exceeds a presetting noise threshold, otherwise the input gray signal is considered as noise and is outputted after noise reduction modification.

10. The method for driving a LCD device as described in claim 9, wherein the method for noise reduction further satisfies

$F_n' = F_n$ if $|F_n - F_{n-1}| \geq N_{th}$,

$F_n' = F_{n-1} + a(F_n - F_{n-1})$, if $|F_n - F_{n-1}| < N_{th}$;

wherein F_n is the current field image data, F_{n-1} is the preceding field image data, F_n' is the modified current field image data, N_{th} is a presetting noise threshold , and a is a presetting parameter, which satisfies $0 \leq a < 1$, or can be changed in accordance with the noise level, satisfying $a = f(F_n, F_{n-1}, N_{th})$.

11. The method for driving a LCD device as described in claim 7 wherein the method for modifying the input gray signals by the gray signal modulator further comprises a signal preprocessor for detecting a certain character of the input gray signals and then sending a flag that represents said character to the signal converter for providing different signal converting schemes.

12. The method for driving a LCD device as described in claim 11, wherein said character of input gray signals detected by the signal preprocessor includes different video systems, different frame rates, images with different signal-to-noise ratios, different interfaces or user dependent parameters.

13. The method for driving a LCD device as described in claim 11, wherein said different signal converting schemes can be achieved by using multiple look-up tables.

High-Quality-Image Liquid Crystal Display Device and the Driving Method Thereof

A liquid crystal display (LCD) device and a driving method thereof are disclosed. In order to obtain high-quality images, a signal preprocessor is incorporated in the gray signal modulator of conventional LCDs. The signal preprocessor can be specifically designed as a noise-reduction preprocessor for suppressing the noise induced from the input gray signals, or designed for detecting a certain character of input gray signals for further processes. After be processed by the signal preprocessor, optimized modified gray signals can be obtained from the signal converter for driving the LCD, thereby producing high-quality images.